Apple Lisa Computer Technical Information

Apple Lisa Computer: Apple’s Dan Kottke Interview (St. Mac • August 1984)

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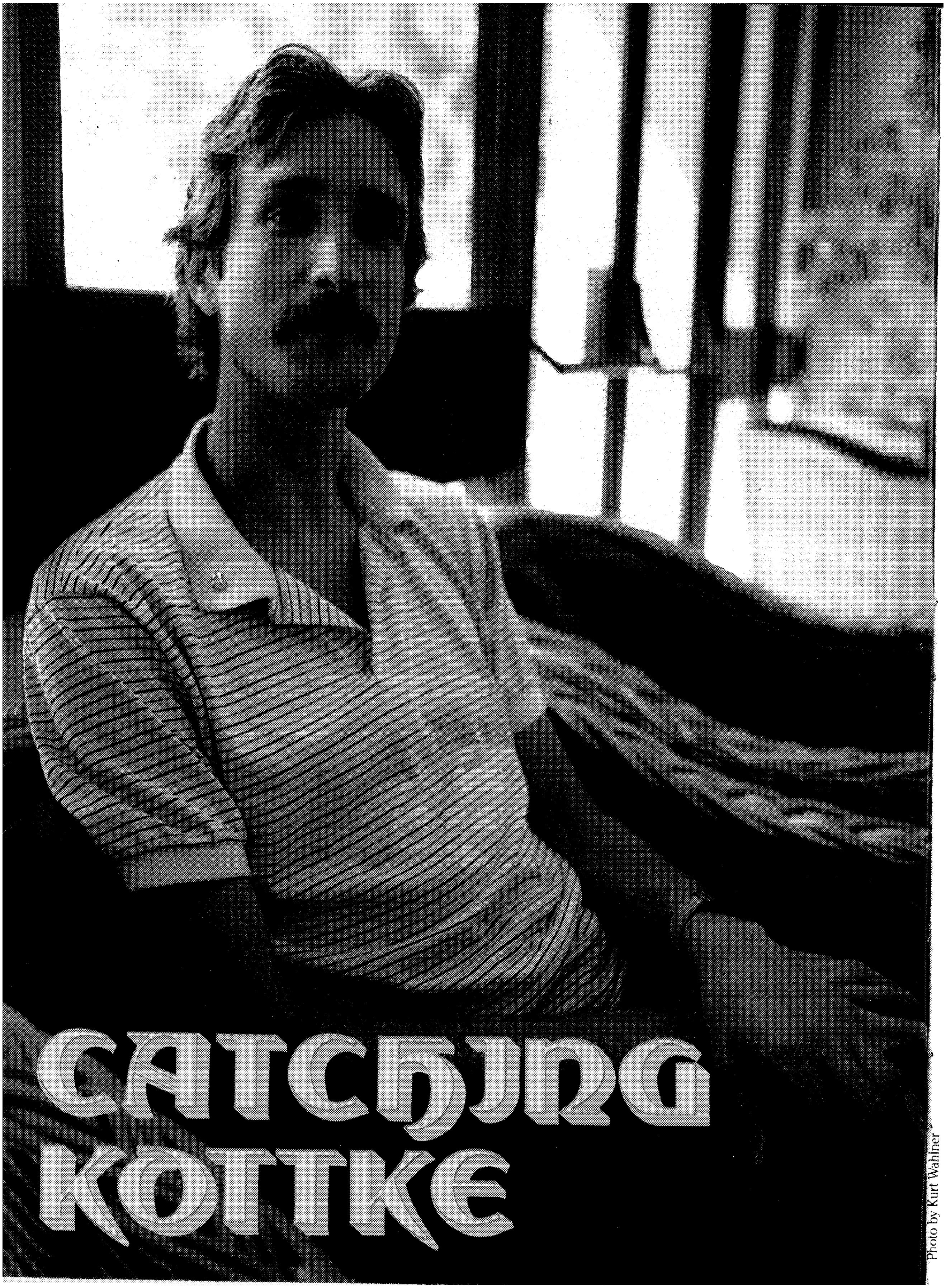

CATCHING KOTTKE

Photo by Kurt Wahlner

The Straight Stuff from One of Apple's 'Grand Old Men'

by DOUG CLAPP

Who to interview? Burrell Smith was out; he was too busy designing "secret projects" and recovering from "media overload." Donn Denman was out, for now, because he hadn't finished MacBasic when this interview was scheduled (maybe next time).

And Steve Jobs hardly talks to anybody, and Apple president John Sculley, even if available, probably wouldn't divulge any juicy tidbits, so....

Who to interview? After long minutes of furious thought, the name Dan Kottke leapt to mind. Dan is a hardware engineer on the Macintosh project, is one of the original Apple employees, knows lots of interesting Apple stuff, is quick with an opinion, is neither blindly "Apple Forever" or "Everything's Junk," and is just generally a fun guy to hang around with.

With that in mind, writer Doug Clapp and *ST.Mac* editor Pat Ryall went to Cupertino for two marathon sessions with Daniel Kottke. The subjects ranged wildly, from Apple's unreleased networking system (called AppleBus, which allows computers to be tied together and communicate directly) to the magical SCC communications chip in the Macintosh to "early Apple," Alan Kay, laser printers, pricing, marketing, hard disks, color Macintoshes, and more.

What follows is not the official word from Apple, but we think you'll find it interesting nonetheless. We did. And we found that, just as we suspected, Dan *is* a fun guy to hang around with.

Kottke: I don't know if you've got any good ideas for an angle on this interview. Because I'm not involved in any hot projects right now, and even if I were I couldn't tell you about them. But you know that AppleBus and the laser printer are the big upcoming products, and I really shouldn't say much more than that.

DC: That's okay. AppleBus is boring anyway.

Kottke: AppleBus is not boring; it's really exciting!

DC: Really?

Kottke: I think it's one of the neatest things we've ever done.

DC: Well, it doesn't really affect the typical home user or the hobbyist.

Kottke: Potentially it does affect the home user with regard to getting extended use out of Mac's serial ports. But beyond that it's exciting in terms of the marketplace. It's like a whole new level—it gives a whole new dimension to the machine [Macintosh].

DC: And it's a great attack on IBM.

Kottke: We're not doing it just to attack anyone. We're doing it because we're able to do it. In a sense, we're doing it because we've got this great chip called the SCC that makes it possible, in the same way that the 68000 makes the Macintosh possible.

DC: Let's talk about the SCC chip. Is the Macintosh the first computer it's been used in?

Kottke: I don't know, but it's a very new chip, and Burrell [Smith, Mac's hardware architect] found it—I don't know who tipped him off to it. Zilog makes it. It hasn't been out very long.

DC: Tell us about "bandwidth." Because there's been a lot of talk about the speed of the SCC chip, saying that it's fast enough to handle both voice and data at the same time.

Kottke: I've never heard anyone say that; in fact, I don't think it necessarily makes sense. Let's just look at the rough numbers. What are the bandwidths of audio or analog signals? On the low end, you have telephone-grade audio, considered to have a 3-kilohertz analog bandwidth—by bandwidth here I mean highest frequency component. If you digitize that, which is what voice-mail companies do, you get a bit stream with a baud rate or digital bandwidth consisting of the wordsize times the sampling rate. Recognizable speech can be as slow as eight bits times 6 kilohertz, making 48 or 50 kilohertz. Mac audio is eight bits times 22.7 kilohertz, or about 180 kilohertz—almost four times better. Digital Audio Disks run at about sixteen bits times 50 kilohertz, which comes to 800 kilohertz, or four to five times better still. The Mac Sony disk transfers six bits every sixteen microseconds, which gives you about 375 kilohertz, which is twice as fast as Apple's Disk II.

But what does all this mean? Well, was our comparison against the SCC chip itself or AppleBus? Let's look at both. The SCC chip will run flat-out at 1 megahertz, almost as fast as the Mac's bus cycle. Software can't keep up for long with data at that rate. I heard that the Tecmar hard disk for Macintosh runs at about 700 kilohertz. AppleBus runs at 230 kilohertz. Since we said that Mac sound runs at 180 kilohertz, that means, theoretically, you could send a continuous sound channel over AppleBus with room left over for data—and no useful time left over for the processor!

Anyway, the thing that's particularly great about the SCC is that it allows "header recognition." Header recognition means—I'm trying to think of a good analogy. It's like a receptionist at a desk screening your calls.

DC: What's a "header"?

Kottke: When you do any kind of local area network the basic data structure is the "packet." As in "packet-switched network," a common phrase.

DC: Right.

Kottke: And every data packet has a header. A packet is basically like a sector of data on a disk. Sectors are usually either 256 bytes or 512 bytes, and it makes sense to have uniform sector size on a disk to efficiently fill the space. On AppleBus, packet size will be variable but no greater than 600 bytes and at least 3 bytes.

DC: And that's the "header"? So the smallest packet is just a header?

Kottke: Right. And what the header tells you is "where it's coming from," "where it's going to," and "how long it is." Okay? And, when you've got a network, there're millions of bits flying by, all the time. You can't go interrupting your processor for every single message. So you really need what's called "header recognition." And, generally speaking, that's done by an entire circuit board. But all that's built into the SCC chip. The SCC chip is always looking at the data line; it's always taking in data. Every time it sees data, it takes in the first couple bytes and compares them with a register it has, which has its own address. And if the address doesn't match, it says, "Oh, well, not for me."

DC: So the SCC's like a processor? It's got registers....

Kottke: It's got registers, and it's very complex. It's not really like a processor; it's a *communications controller*. It doesn't have the same architecture a processor does, by any means, but it has "smarts." So anyway, we have this chip, and it's always looking at the AppleBus. The only time it interrupts your Macintosh is when it finds a packet that's addressed to you. Having a secretary answering your phone is a good analogy. It's as though people are calling your number all the time, but a lot of the calls are not necessarily going to be for you personally. But anyway, back to the subject: Have we got any interesting things we can talk about?

PR: I want to hear about laser printers!

Kottke: Well, quite honestly, I don't know much about the laser printe

"I remember seeing the first color Apple logo and thinking, *This is significant*. And I just knew the company was on good footing."

project we're doing. We've got one guy doing it, and he's doing it in a closed room, and it's locked, and the guy doesn't talk, so I don't know much.

PR: It was more of a personal question anyway.

Kottke: Well, I can tell you what I think they're good for without having any specific references to our products. Laser printers will enable people to do a lot of work themselves without requiring a typesetter.

PR: I'd love to see typesetting made obsolete.

Kottke: Typesetters are very concerned!

PR: I do *a lot* of typesetting at work. (*laughter*)

Kottke: Typesetters are going to go out of business!

PR: We could all go into designing fonts. None of the Macintosh fonts are anything we could use for body text in the magazine. Somebody needs to get everything that's on a typesetting system onto a computer.

Kottke: The main thing is that the laser printer does for typesetting what the computer did for writing text. On your desk, you can compose with your Macintosh or Lisa or whatever, and you can print out things that are acceptable camera-ready artwork.

DC: How fast?

Kottke: Acceptably fast. I think almost anything is acceptably fast. Speed was never that much of an issue. It's like—if you're printing out 100 copies of a letter, you should get a Xerox machine! But that's the whole thing. A laser printer is a Xerox machine. *It is!* It's a Xerox machine that's independently addressable with a laser. So you can use it strictly as a Xerox machine, or you can dump down into it from your computer.

PR: Well, we have an understanding at work: We can't get a laser printer until they're less than $4,000.

Kottke: We hope to do that by the end of the year. Seriously. You know, that's what Steve Jobs is really good at: visionary product direction. And he's really right on. He's the one who's pushing for laser printers. But the people that make the printer mechanisms deserve most of the credit. Those things are really hairy. It's hard to get those things to work. And we're taking the mechanism, and attaching a computer to it, and making a package out of it. It's the same way that Sony should get credit for the 3 1/2-inch drive. We didn't make that drive, and we would *not* have done it. We tried making 5 1/4-inch drives and it didn't turn out to be a smashing success.

DC: True enough.

Kottke: In fact, I would say that the "twiggy" drive [used in Lisa before being discontinued by Apple] was not a bad thing. The Apple III's not a bad thing. But the technology moves so fast. If you're doing kind of an "evolutionary" product, you fall behind. You have to take leaps. And the twiggy was basically a reengineering of products that had already existed. It was great, five years ago, when it started, but the whole project just dragged on.

DC: Five years?

Kottke: Yeah, and Apple's main product stream is not making disk drives. But we're making our own hard disk drive that we're shipping in the Lisa, and, from everything I've heard, that drive is just great. We designed and built it from the ground up, so ultimately it should be cheaper than anything else we can buy.

PR: That's the ten-megabyte drive?

Kottke: Yeah, and it's working really well. It's not in high volume yet. We're shipping it in the Lisa 2/10, and I think at some point we may introduce it for the Macintosh. I hope that works out because, eventually, all our computers are going to want hard disk drives, or a very large percentage of them. The technology is clearly here to stay. I don't see any huge magical breakthroughs coming along the line to replace that technology.

DC: How did you get involved with Apple?

Kottke: I was always interested in electronics. But the funny thing was, for the first couple of years that I knew Steve [Jobs], I didn't know that he was interested in electronics. Steve was my friend on kind of a literary-philosophical level. He was the friend of a dormmate and had these Bob Dylan tapes playing one day, so I just sat down and listened. At the time, I never even knew he was involved with "blue-boxing" [illegally making long-distance phone calls with the aid of hardware cleverness]. That was a secret, I guess.

DC: You were in college when Apple first started?

Kottke: I was a junior at Columbia in New York City when Steve started Apple. And I just came out for a summer job.

DC: Who was here when you came out?

Kottke: At Apple? Nobody!

DC: You mean it was just Steve and his sister?

Kottke: Literally. When I came, Steve's sister was plugging chips onto the Apple I logic board, and not doing a tremendously great job. So I started doing that: I assembled Apple I logic boards, and I tested them.

DC: You got paid?

Kottke: Oh yeah, I got three dollars an hour!

PR: What year was that?

Kottke: 1976.

DC: This was when Steve Wozniak was at Hewlett-Packard?

Kottke: I didn't know Woz for quite a while. Woz was never around the garage. He'd come by every week or two, but he never hung out there a lot. I think Woz was intensely busy at that time. The Apple I had already been designed—that was when he was working on the Apple II, though I didn't know it at the time. He was staying up late nights, prototyping the Apple II, writing code for it, writing Integer Basic, writing the Monitor routines.... That's why I never saw him.

DC: This is after Paul Terrell's ordering the Apple I's for his Byte Shop?

Kottke: Not long after.

DC: The first order was how many in a month?

Kottke: I'm not sure. I think $30,000 worth.

DC: At $600-something each?

Kottke: That was the retail price. I don't know what the wholesale price was, so I don't know how many systems that entailed. As a ballpark figure, say $400 wholesale? That's a good markup. From $400 to $660? I think I came in on the tail end of filling that big order.

DC: Legendary numbers.

Kottke: And there was no daily production. It was just a batch job: You got a bunch of boards—you got 'em all stuffed at once—and then they all sat in a pile. One by one, a day at a time, we'd get around to testing them. It was very spotty work; we weren't working at it full-time. I was getting paid by the hour, and just a couple of hours a day; that's all it was. If I had been seriously looking for a job, I wouldn't have hung around. I liked the computer. I did my best, all summer, to learn how it worked.

DC: The summer of '76?

Kottke: In between my last two years of college. I went back for my senior year. I didn't have a full-time job at Apple anyway. At that point, Apple was a partnership and hadn't incorporated yet. And, during my senior year at school, Steve would call me up and tell me how things were going. He'd say, "We've got this great company started; you've got to come out and work for us!" So, the same week I graduated, I immediately came out. They'd incorporated in January 1977. And sometime in the fall of '76 Steve had met Mike Markkula, and the business plan coalesced; Markkula put in $90,000 and they formed a corporation. They had to get the case designed, to get Rod Holt to design a power supply, and then they had a product.

DC: So when you came back that summer, how many people were there, and who were they?

Kottke: There was a real, functioning company. Mike Scott [then president of Apple] was the skipper (he's always reminded me of "The Skipper" on *Gilligan's Island*), and there were twelve people there. I was the twelfth employee. Rod Holt was chief engineer. Scott, Markkula, Holt.... Wozniak had a number but didn't work there full-time.... Sherri Livingston, who was Mike Scott's secretary.... Jim Martindale was production supervisor; he came from Atari.... Then there was Jobs.... I don't know how many we're up to.

DC: Seven.

Kottke: Randy Wigginton...Chris Espinosa—both of them were kind of working part-time, helping Woz out—and Don Breuner, who was hired just days before me. And Bill Fernandez. And I was number twelve.

DC: Wigginton's the author of *MacWrite*, but what did he do in the early days?

Kottke: Well, his first big claim to fame was working on Applesoft. At that point, Woz was personally having a hard time, and Randy was very helpful in getting Applesoft ready, which was important, because Integer [Basic] has many limitations. And I immediately started screwing together power supplies and base plates and keyboards. That was my first job: I had a screwdriver in my hand. Because it needed to be done.

DC: When did things really take off?

Kottke: The important milestones, to me, were around the fall of '77. Well, we shipped our first unit in June, then quickly jumped to ten, twenty, thirty or forty a day for a long time. I was in production for the whole first year, and when I left production we were still doing only fifty or sixty a day. The first manual was just a folder—Mike Scott threw it together in a hurry. The logo was black. And I remember seeing the first color Apple logo that fall. And I recall thinking, *This is significant*. It was such a great logo! And I just knew that the company was on good footing. It was just intuitive. It seemed like a good omen. God, a rainbow logo! Why doesn't everybody have a rainbow logo!

DC: Okay, how did the Macintosh get its start?

Kottke: Well, Steve got Macintosh to happen. He didn't start it—he kind of took it over from [Jef] Raskin—but he had the vision. And that's what he really sees as his job: He's Apple's visionary. Now, I think it's way too sanctimonious to put it that way, but, on the other hand, that's what he does best. He sets the general direction. And Macintosh was right on. No one else was responsible for it.

DC: What did Raskin originally have in mind?

Kottke: It was the idea of a small, personal, "appliance" computer, as opposed to a "hobbyist" computer. Now, the concept of an appliance computer has many issues, because in order to be an appliance it has to be simple, easy to use, and nonthreatening. You could almost say that, by implication, it has to be graphic. Now, Jef's machine was less than half the price [of the Macintosh]. On the other hand, it started in 1979, so....

DC: There were tremendous arguments, before release, about pricing the Macintosh.

Kottke: Personally, $1,200 was my limit. Now, again, I'd revise that, because that was years ago. But I'd still say that, if I didn't work at Apple—if I were a student—I'd say $1,500 to $1,600. I could see spending that much. If I were in a consortium school, I'd be really happy. Even then, you get the computer and the printer and the modem and you're talking $1,600. But students don't have much more money than that.

DC: If they have that much!

Kottke: Yeah. It's like a car. But I think that Macintosh is the first

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> "We're still unrolling Macintosh. We're still on trial. We've shown what we've got, but we've got to keep pushing it and supporting it."

product that Apple's made that I'd buy, even if I didn't work at Apple. Well, not unless I had a good job.

PR: Is Apple on the right track selling Macintosh as a business computer? We get a lot of letters from people complaining, "I bought one because I thought it was a 'business computer,' and it isn't!"

Kottke: The word "business" has a lot of connotations. "Letter-quality printing" is a pretty big part of it. If you go into the Macintosh building, you'll see many letters posted on cubicles that people have sent in, and they're basically business letters. Letterheads and so on. All printed with a Macintosh. And I think they look great.

And yet the laser printer is going to put the whole letter-quality issue to rest. The whole thing of "letter-quality" is like wearing a tie and a jacket to work. It's the same ethic. The real question is flexibility and "niceness" and aesthetics, and whether it makes your job easier. The Imagewriter is such a beautiful machine; the Imagewriter and Macintosh go together so well that I don't have a lot of sympathy for people who say, "It's not letter-quality!" But I do have sympathy for people who already have daisy-wheel printers and can't run them with the Mac. That's real bad. It took a while to convince Steve [Jobs] of that. But now we're fixing that, and that's a very high-priority project.

PR: This is way off the subject, but a friend realized the other day that the Macintosh doesn't have a Monitor [a ROM-based program that allows users to examine, change, copy, and disassemble blocks of memory]. And was he pissed off!

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Kottke: Actually, what the Macintosh does have is a debugger program called "Macsbug."

PR: "Macsbug?"

Kottke: Yes. It's the general-purpose Monitor and debugger program that we originally got from Motorola for the 68000 and that was extensively rewritten for Lisa, then crunched down somewhat to run on Mac. You get into it by hitting NMI or having a break point in your code. The name comes from "Motorola Advanced Computer Systems" (MACS). There's also a desk accessory I've seen that just lists memory. I think when you have an integral disk drive like Macintosh does, it's not much of a disadvantage to have something like that on disk instead of in ROM. It's not used that often.

PR: So how can you get Macsbug?

Kottke: It isn't generally for sale—at least not yet—but you can certainly get it if you're a developer or a persistent annoyance. Or even a sincere seeker.

DC: And the nonmaskable interrupt instruction...that's like a crank in the microprocessor that you can turn to get things moving.

Kottke: Well, it's not an instruction. It's a button connected to a pin on the 68000. And all it does is send the processor to a specific address in memory from which it jumps to wherever you want—similar to the reset button. I don't think that's too technical for people to know. And the concept of a Monitor program is something people would probably like to know about also. Because that's—well, I was exposed to mainframe computers in high school. And I was not inspired, in any way, to deal with them. They were unfriendly, big boxes that were inaccessible. There was *no Monitor*! There were switches and lights on the front, but that was way too arcane. There was no simple way you could just go in and examine memory locations. And that's what was refreshing, and eye-opening, about the Apple II: All of a sudden the machine was yours! You could sit there, turn it on, and you had access to every byte of RAM. And that was what got me, personally, interested in the machine.

DC: And that's what a lot of people don't like about the Macintosh.

Kottke: That you can't do that. Yeah. But, the fact is, you can! It's just a different way of going about it.

PR: But with an Apple II, you can just buy one, then go in the Monitor, and....

Kottke: That's true. And, in some ways, the Apple II is a better instructional machine for that reason, because it's very simple. But it's a whole spectrum; because, at the other end, the Apple II kind of "breaks down" for doing high-level stuff—the processor doesn't even have interrupt or exception vectors. It's a very simple system. Macintosh is a whole order of magnitude up in terms of system complexity. Everything in a Macintosh happens on interrupts. You can have all these different simultaneous tasks—Macintosh can really be a concurrent machine, without much trouble. Your desk accessories are, after all, concurrent applications. You can have seven different applications running concurrently.

DC: On another subject, how's Sculley doing?

Kottke: Sculley's worth the money. I think Sculley's doing a great job.

DC: How much is Sculley doing?

Kottke: A lot. If I think back a year ago about the impressions people had of the Apple II division—"PCS" [Personal Computer Systems]—before Sculley, PCS has really pulled it together. They impressed all of us with the IIc and the IIc monitor. They just really got their act together. That's a great division! I don't know how much of that is Sculley's doing, though.

DC: I remember old PCS jokes. "What's the difference between PCS and the *Titanic*?" "The *Titanic* had a dance band." *(laughter)*

Kottke: I did hear that the Apple IIc event, in the [San Francisco] Moscone Center, was largely Steve Jobs's doing. They [PCS] were just going to have this modest press announcement for the IIc, and Steve Jobs went in and said, "Hey, c'mon! We're doing great things! Why don't you do great things too? Why don't you go rent Moscone Center?" And I think that's right on!

DC: What would you like to see Apple make that it isn't? What's on the horizon?

Kottke: That's what is most visibly Sculley's influence, from my point of view: the unified product range. And he's the only one who can do that. Sculley is the guy who can unify these various divisions—such as the Apple II and thirty-two-bit families—and then group them together on a spectrum. Jobs can't do that, because he's too partisan, being general manager of the Macintosh division.

DC: But productwise, what's next?

Kottke: I think we've got our hands full, for at least another year, just building IIcs and Macintoshes and helping the software get out for the Macintosh. You know, we're still unrolling Macintosh. We're still on trial; we've shown what we've got, but we've got to keep pushing it and supporting it.

DC: Apple seems to want to keep the 128K Macs alive, but everyone I know wants a 512K machine. Everybody!

Kottke: The thing to remember is that the 512K Mac is going to be $1,000 extra worth of RAM. And there's no way around that. Not within this year, I'd say. But for new products—well, you know, inevitably there's talk of a "Big Mac," a "Cheap Mac," and a "Lap Mac." If you think about what the "Cheap Mac" is, that's exactly what we already have. The Mac we have is the cheapest thing you could get in terms of a usable configuration. And you could only go up from there: double-sided disks, 512K, color capability, two drives....

DC: So you keep the "Cheap Mac" and just crunch the price?

Kottke: That's right. And that's exactly what we need to do. The Apple IIe, for instance, is now being discounted to $800 or $900. And it'll get even cheaper.

DC: And to build a Macintosh must cost...under $500, easily.

Kottke: Well, it's hard to say, because it's very expensive getting a factory started up, and you've got massive amounts of overhead.

DC: So what do you include in the cost?

Kottke: Right. What do you include?

DC: Do you include Sculley's salary in the cost of a Macintosh?

Kottke: Another good point. *(laughter)* But the factory is really quite awesome. It's like being in a high-tech aircraft hangar filled with machinery.

DC: Is the romance gone from Apple? It's not like the days of twelve Apple employees.

Kottke: No, it certainly isn't. What I've seen over the years are teams of people that swell up and balloon in order to get a product out the door, then level off and slow down a bit, then eventually disperse. It seems like often the people who contribute the most tend to be the ones who get restless to move on to something else. But, you know, with all due credit to Steve Jobs, it's perhaps getting to be time for him to start putting together another small group. In 1980, it was getting the same way: The Apple III was out, and everybody was exhausted, going on leaves of absence, and Steve went in and started hand-picking people to "go to work on this little project"—the Macintosh. And it was like this new, little company—all over again. We moved out, moved into our own little offices—it was just like being a new company. Except that we didn't have to worry about expenses. Steve could do that again, and maybe he will.

PR: Do you think he'll do it around something Alan Kay's working on?

Kottke: That's a whole 'nother question. I think Alan's great, but I tend to be a little skeptical....

DC: There's not much evidence of his "greatness."

Kottke: My evidence is talking to him. In fact, everyone who talks to him that I know—well, you know Mike Boich [Mac "Software Evangelist" and *MacTerminal* author]? It was funny—one of the first times that Alan came to Apple, he was by to see Steve Jobs, and Steve was busy and handed him off to Mike Boich—like, "Here, keep this guy busy for a while!" Well, Mike said he took Kay into the demo room and was showing him *MacTerminal*. But Boich said he could only take it for ten or fifteen minutes because Alan was overwhelming him! It was like, "This guy is just too smart! I can't take it anymore!" *(laughter)* Coming from Mike Boich, that's a compliment, because Mike's a really bright guy.

DC: But is Alan Kay "all heat and no light"?

Kottke: Well, he's *all* light, actually—the guy's brilliant. But one of the things about Alan is that he's very far ahead of the times. And that seems to be where he wants to be. But he doesn't have a reputation for shipping products.

PR: Maybe he doesn't want to make "real products."

Kottke: Which is fine. That's great! It's kind of like being a nuclear physicist—you're so far removed from reality; you're dealing with equations all the time. And yet, your work is very valid and necessary. Actually, I get the impression that Alan sees himself as specializing in user interfaces, which is potentially a very tangible subject. After all, like the Skeptic philosophers said, all you really know or experience is what you see, touch, hear, etc. *That's* user interface! I don't know. Alan worked on Dynabook, which was clearly way ahead of its time, so you can't blame him for not shipping that one! Then he worked on the Star 8010, whose fate is surely mired in the monolithic heart of Xerox. *(laughter)*

DC: Let's talk about important new products. Is there color in Mac's future?

Kottke: Well, it's like this. It's not that hard to design a Mac or modify a Mac to put out, say, sixteen-color RGB to an external monitor. You could even use the current Mac CRT and get sixteen-level gray scale and use color-mapping registers to get four thousand colors or so. The additional cost is mostly just in the extra RAM to quadruple your screen buffer from 20K to 80K and the cost of the RGB monitor.

PR: Then a color Mac wouldn't have the color tube built into the box?

Kottke: Probably not. You'd want to use the same black-and-white tube and have an external RGB video connector. Apple's even announcing an RGB monitor this summer. So, obviously, it would make sense for us to use that monitor.

DC: How big is it?

Kottke: The same size as the IBM monitor.

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PR: Twelve-inch?

Kottke: Uh, yeah. I think it sells for five hundred-something. It's a pretty good price.

DC: More, more! Is the color Mac...pretty?

Kottke: Yeah, and—

DC: Can you set the background colors and the text colors? Menu bar color!?

Kottke: Of course you—

DC: Color, gee! Can you—

Kottke: No, those are—wait, wait, wait! Let's get this straight. The biggest question is how do you deal with all these colors in software—you have to have all kinds of new menu items and options and preset values. And then, relative to other things like disks and modems, is it useful and necessary enough to justify the cost? It's a big software job; and, of course, you can't make a product out of just the hardware, you need a complete package. I think a color Mac would be great, but I'm not sure it would necessarily get more work done. It sure would look nicer.... I mean, years ago we all thought that the Apple III was such a great machine because it had that sixteen-color RGB hi-res, which looked so beautiful, and all you needed was an RGB monitor. And yet, how much software do we see exploiting that color? None! In fact, with an extended eighty-column card, you can get the same color out of an Apple IIe. And I still haven't come across much great color software—other than games, of course. Still, I'd like to think that we'll put color capability at least in the hardware in a future Macintosh.

LISA

DC: How do people in the Macintosh division feel about Lisa?

Kottke: You know what really bugs me? This is something that I'd like to see in print: I hear talk, even within Apple, about the Lisa being a "failure." And that really irritates me, because I'm proud of Lisa. I think it was a great success, even though it wasn't a "profit center." It made its money back. It wasn't a loss. The fact is that Lisa established us firmly as a technological leader, which is a very important thing. Just think if Lisa hadn't worked. I mean, the Apple III was...kind of embarrassing—for a while, at least.

PR: But how much of Lisa's "failure" was the machine's fault and how much was marketing?

Kottke: Marketing kind of overestimated the extent to which Lisa would sell itself.

PR: That's an understatement.

Kottke: But that's basically the issue—that it was marketing, not the machine itself. Overestimating sales potential leaves you with pricing that's too high in general, and our strategy of bundling everything together made for an uncomfortably high entry-level price. Another thing that hurt was not having the software development Toolkit ready earlier. Developers really needed Toolkit to make third-party software, but the whole thing kind of stumbled and faltered. It was a mammoth project and took everyone's energies just getting the whole package to work in the first place.

DC: Is Macintosh going to "save" Lisa?

Kottke: I don't think there's necessarily a relation. Macintosh is a very good thing for Apple in general. Lisa was a stage we went through that was successful in some ways and not successful in others.

DC: But lots of people go out to buy a Macintosh and decide they need a Lisa instead.

Kottke: That's right; Lisa's a more powerful machine. A lot of people need that megabyte of RAM to deal with very large documents. And a lot of people want the convenience of multitasking. Lisa's also a great Unix machine.

PR: Are the rumors true that Apple's phasing out Lisa and discouraging Lisa software development?

Kottke: I think that makes no sense at all, for the reasons I just described, but if I say any more, it'll be my job that's phased out!

PR: Is Apple going to kill off the ProFile hard disk?

Kottke: Maybe what you mean is will Apple continue to use the current five-megabyte Seagate drive that we build into ProFile? That's like asking if we'll continue to use 64K RAMs in our computers! For years we've all watched RAMs and disk drives get denser and cheaper—and then, of course, the whole point of our own ten-megabyte Widget project [Widget is Apple's name for the hard disk within the Lisa 2/10] was so that ultimately we wouldn't have to go outside the company to buy our drives. If we acknowledge that hard disks are desirable and here to stay, it makes good business sense to try and build our own. The other side of the issue is that hard disk drives are very difficult items to make reliably and in high volume. And do we think we can compete effectively with all the other companies who do *nothing* but make these drives? Hmmm.... I would expect that Apple will continue to make a product called ProFile regardless of whose drive is in it.

PR: How close are we to seeing a 512K Macintosh?

Kottke: I think that 256K RAM availability is a questionable issue. Devices that dense are starting to really push the limits of existing wafer-fab equipment. It's a question of the chip vendors improving their yields enough to bring the price down. The 256K RAMs are still many times more expensive per bit than 64K RAMS.

I heard a curious thing the other day about 256K RAMs. An engineer at the Mac factory was talking about some 512K Macs that we were building up, and the RAMs seemed unusually susceptible to "flyback RFI." The flyback yoke in any CRT produces a big, whopping electric field. And one of the problems has always been shielding the disk drive from that field. Well, the transistors that make up the 256K RAMs are very tiny devices. And the smaller the device, the smaller the currents. And the smaller the currents, the greater the significance of "background noise" such as the electromagnetic field from a flyback yoke. At some point, the field will cause failures of the device. We're going to have to be very careful when we start making 512K Macs to test them for this type of parasitic effect.

DC: What about the 800K, double-sided drives for Macintosh?

Kottke: That's similar to the 512K Mac question. It's mostly up to our vendors—that is to say, Sony, in this case.

DC: End of the year?

Kottke: Could well be. The double-sided drive is more a matter of gearing up production—it's not a thorny engineering problem.

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